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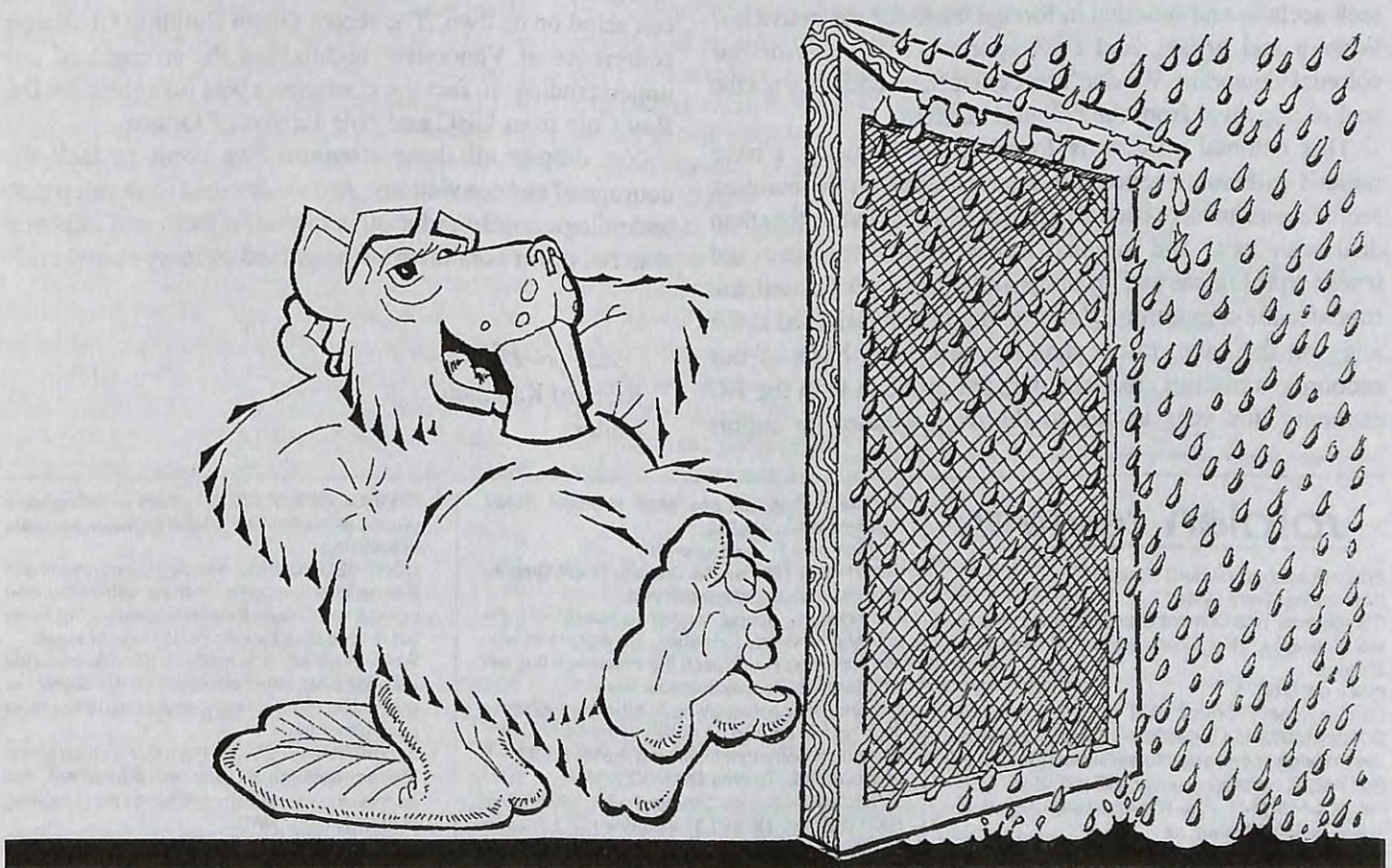
Rain Screen Walls



From the Editor . . .

The new year has given us the Euro, a new global currency to compete with the US Dollar and the Yen. Now we can focus our attention on what that all means as we watch the computer nerds scramble to fix up the problem they created with computer date codes.

So what, you may ask? Business thinking and economic fashions of the past few years are driving us to a uniform global economy. What is seldom considered is the meaningful impact all this common activity is having on local communities.

Canadians, for all their outward thinking and global perspectives seem to be mired in a colonial mind set. We lack the self respect and conviction of our ideas until others give their approval. Never mind that we have expertise and knowledge respected world wide. We seem to need to get approval from others - mostly the USA and Britain for English Canada, and France for Quebec. We've seen this in literature, music and art. We also see this in our science and technology.

How else to explain the tremendous effort being made to seek acclaim and sanction in foreign lands for our activities? Writers and artists, and even sports heroes, mirror our colonial viewpoint. We don't recognize them until they get the seal of approval from the colonial masters.

This colonial attitude is found in our industry. I have noticed with some concern how much effort in the building sector seems to have been targeted at exports first, rather than deal with local and national issues. Unlike transient and transportable ideas and products, buildings, by definition, are rooted in the community. Exports should be considered as the icing on the cake, rather than the sustaining basis of our economic activities. In large part the problem with the BC economy this year is due to the over reliance on export markets for our resources, primarily into Asia. As the Asian economy took a tumble, so did the economy. It is not just the resource product export sector that is feeling the pinch, but even the housing and renovation sector.

The R-2000 program is technically sound and well respected. However, it seems that as much effort is being placed on exporting the technology (in some cases at little or no cost) as on nurturing and encouraging its use and application in Canada. The latest version of the HOT-2000 software was launched in Washington rather than in Canada. (Maybe it is a confirmation of who really calls the shots?)

Our building science expertise is second to none, yet we have a hard time maintaining our infrastructure for the benefit of Canadians. Increasingly, any attempt to undertake research and development has to be done in the name of export potential. If the Americans get involved, chances are a project will get support quicker.

Our understanding of sustainable, green building technologies may not be as advanced as some Europeans, but it can stand on its own. The recent Green Building Challenge conference in Vancouver highlighted the strength of our understanding. In fact the conference was instigated by Dr. Ray Cole from UBC and Nils Larson of Ottawa.

Yet despite all these strengths, we seem to lack the courage of our convictions. Are we doomed to develop new technologies, only to let others develop them and import a watered down version after its gained success elsewhere?

Richard Kadulski,
Editor

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Driving Rain and its Effect on Wall Construction

Moisture is one of the most important factors affecting the durability and performance of building envelopes. Driving rain puts more water on the above-grade building envelope than any other source of moisture in most building types and climates. Controlling driving rain is thus a crucial part of any moisture control strategy.

How much water is put on a wall depends on the interaction between the wind, rain, building shape, and the building envelope. On an exposed low-rise building it can easily exceed 100 kg/m²/yr. Even if the rate of rain accumulation on a building surface is known, the relative amount of absorption, drainage, and penetration of water will depend on the cladding material, its texture, and previous wetting history.

Wetting can result in staining, water leakage, dimensional change, freeze-thaw damage, leaching, efflorescence, and biological deterioration. Water penetration of the cladding can cause problems inside the wall.

Overall, vulnerability to moisture problems depends on the exposure of the wall and its microclimate, location of the relevant portion of the material in the wall and the location of the site. Vulnerability also varies with the potential for wetting, the potential for water storage, and the drying potential. If a balance between wetting and drying is maintained, moisture will not accumulate and moisture-related problems will be unlikely.

Driving rain is not routinely measured by weather stations. A driving rain index (DRI) has been developed to predict driving rain magnitude, but this relies on available rainfall and wind speed records. During storms the actual wind direction does not always match the long term average wind data.

Over the past six years a variety of full-scale wall systems with clay brick veneer, vinyl, and EIFS cladding have been field tested in the building envelope test facility at the University of Waterloo. The tests have found that exposure to driving rain can vary by a factor of more than eight depending on the orientation of the building.

It is both practically and economically impossible to remove all moisture sources, to build perfect walls, to remove all forces causing moisture movement, and to use only materials which are never susceptible to moisture damage. While in theory eliminating any one of the four conditions listed above will avoid a moisture problem, in reality one should deal with two or more of them to reduce the chances of moisture problems.

For a moisture problem to happen, at least four conditions must be present:
1. a *moisture* source
2. a *route* for this moisture to travel,
3. a *driving force* to cause moisture movement,
4. susceptibility of the materials and/or assembly to moisture damage.

Controlling moisture and reducing the risk of failure through careful design, construction and material choices must be the approach taken to create durable building envelopes. Different materials and assemblies have varying susceptibility to different kinds of moisture-related damage.

The performance thresholds are poorly defined for most construction materials and assemblies. For example, the conditions necessary for mould growth and rot in wood are well known; but the combinations of environmental and material properties which result in freeze-thaw damage in brick are not as well known.

Condensation of the water vapour in exfiltrating air during winter conditions can deposit large amounts of water within a wall. However, in relative terms, wetting through diffusion is typically not a big item, but is an important means of moisture movement between layers and materials inside a wall.

The three major sources of moisture for above-grade building envelopes are:
- condensation of water vapour moved by diffusion and/or air movement through the wall (usually from interior to exterior),
- rain, especially driving rain, by both penetration and capillary absorption,
- built-in and stored moisture.

Built-in moisture can be important in some wall assemblies. Wet framing lumber, saturated concrete block, or green concrete within a wall all provide large initial sources of moisture.

Most moisture control strategies have tended to focus on reducing the potential for wetting by increasing air tightness and interior vapour resistance, thus reducing water penetration and absorption, etc. However, most building construction is not perfect. Wetting will happen, so attention must be given to designs that increase a wall's drying and/or storage potential.

This article is based on several papers and presentations by Dr. John Straube of the Building Engineering Group at the University of Waterloo. E.F.P. Burnet was a co-author of one of the papers.

Drainage is a very important process for moisture control. If there is a clear drainage path (e.g., cavities, slopes, drainage openings), most rain water penetration can flow out of a wall. However, a small but significant amount of water will be kept in materials by capillary action even when there is excellent drainage. Cladding or sheathing must be almost saturated before water will bead on the surface for drainage to occur. So it must be assumed that water that cannot be removed by drainage will be stored in the wall.

The drying potential is an important factor in assessing a wall's vulnerability to moisture problems. Moisture is usually removed by:

- gravity-driven drainage
- evaporation from the inside or outside surfaces
- vapour transport by diffusion, air leakage, or both, either outward or inward
- ventilation

Moisture not drained from a wall will dry by evaporation.

Drying through diffusion will only occur in an outward direction because low permeance polyethylene vapour barriers are found on the inside of walls in cold climates. Diffusion outward, especially when driven by large vapour gradients in the winter, can remove a significant amount of moisture and be an effective drying mechanism. However, vapour diffusion can move water in the cladding inward where it can cause serious wetting of framing, and sheathing.

Air leakage through the envelope can move much moisture. Air leakage usually leads to condensation wetting in winter conditions, but can also remove moisture. Periodic reversals of air flow from exfiltration to infiltration (for example, when the wind changes direction) can allow drying even under winter conditions. As well, wintertime stack-effect-driven infiltration and summer exfiltration can cause drying. In mild, wet climates, such as on the BC coast, this is not necessarily the case.

However, the largest source of wetting is water deposited on the building walls by driving rain. Unfortunately there is not much information about how much rain, for how long, and how often for wetting to occur.

Ventilation (air flow through a space behind the cladding) uses the drier outdoor air to transport water vapour out of the wall. Capillary action moves moisture within a material to where it can evaporate. For example, water on the back of a brick veneer or wood siding will be drawn to the exterior face where it can evaporate.

The ability of a wall assembly to store moisture may be an important measure of its durability. Storage acts as a buffer between the wetting and drying. If the volume of stored water exceeds the safe level for the material affected and is present for long enough, deterioration will occur, (i.e., rot for wood, freeze-thaw damage for masonry, and corrosion for metal). What is important is how *much* moisture can be stored and for how long without creating a wetting problem.

Moisture in walls is best controlled by selecting materials and designing assemblies with a storage and a drying potential higher than the wetting potential. Due to the amount of wetting by driving rain, rain control should be an important part of a moisture control.

Drainage

Rain on a wall can either be face drained (shed), absorbed (by capillarity), or transmitted into the wall. A wall assembly fails if water penetrates through the wall.

Different surface materials and textures respond differently to rain wetting. For example, most of the water falling onto a masonry veneer screen will be absorbed by the masonry. Only when masonry becomes saturated or rainfall is intense, will rainwater be shed. On the other hand, a glass-and-metal curtain wall will shed water shortly after rain hits the wall, and large surface flows of water can be expected during most rainfalls. Most wall systems are somewhere between these two extremes. For example, EIFS absorbs almost no water while cement-based stuccos behave like very thin masonry veneers.

Although it is commonly believed that air pressure differences are the *primary* cause of water penetration of masonry veneers, there is little scientific evidence of this.

Building Design for Rain Resistance

The beneficial effect of overhangs and peaked roofs has been observed in wind tunnel modelling of tall buildings. Recent surveys in the Vancouver area showed a direct relationship between the size of overhang and the amount of moisture damage. The greater the overhang, the smaller the moisture damage.

A building's design affects the wetting pattern. Wind creates stream lines and pressure gradients around a building. Corners get wet from the wind-generated turbulence. However, where there is any overhang, the airflow is redirected so raindrops fall away.

No matter the building size, peaked roofs and overhangs redirect airflow and effect wetting. For example, a 4-foot wide canopy on a multi-storey building can be an effective and economical means of improving rain control. Observations on traditional buildings have shown that even a small 8" overhang helps control more than just vertical rainfall. An overhang moves the maximum airflow away from the wall by trapping upward airflow near the top. Raindrops in the airflow are unable to undergo such high accelerations and will be pulled down by gravity, but at some distance away from the wall. The droplets may even miss the wall altogether. At high wind speeds the effect is small, but most of the time wind is not a significant factor.

Wall Types

Walls can be either perfect (often called face–sealed) or imperfect barriers.

Perfect (or face-sealed) barriers contain one layer where all rainwater transmitted inward is stopped. Examples of face sealed walls are some stucco systems, window frames, and metal and glass curtain wall systems. Because it is very difficult to build and maintain a perfect faced sealed wall, most walls perform as imperfect barrier wall systems.

Mass walls control rain penetration by absorbing and storing rain water which penetrates the exterior surface. This moisture is eventually removed by evaporation before it reaches the inner surface of the wall. A functional mass wall sheds or absorbs all rain water, thus preventing inward transmission. Examples of mass walls include adobe, solid multi-wythe brick masonry, and single-wythe block masonry.

Screened walls are imperfect-barrier type systems. It is assumed that some rain water will penetrate the surface. The cladding is much more than a rainscreen as it must also resist wind, snow, solar radiation, and impact. A capillary break and a water barrier, are usually designed to resist further inward movement of the water that penetrates the cladding. Examples of screened wall systems include brick and stone veneer cavity walls, wood and vinyl siding and drained stucco and EIFS.

Screened walls limit inward penetration by using several layers (e.g., brick, air space, sheathing paper), each with the ability to drain or absorb water. Rain penetration is controlled by reducing the amount of water transmitted at each layer.

A cavity behind the cladding provides a capillary break, a clear path for gravity drainage and flow. The cavity could be filled with a porous material that fulfills these functions. Several ways of providing for air movement and venting are possible.

Most walls are screened and drained, designed with the expectation that rainwater will penetrate the cladding so the permeance measured in standard tests is of secondary importance. The more important issue, not dealt with by standard tests, is the ability of other layers in a wall system to drain any water that penetrates. Many reported rain penetration problems are in fact drainage failures.

A ***vented wall*** system allows water vapour diffusion and air mixing between the cavity and the exterior. Venting provides the mechanism for the removal of water that does not drain from the cavity.

A ***pressure moderated*** or pressure equalized rain screen wall system reduces the pressure difference across the cladding. The proper choice of venting, i.e., size, number, location, and the division of the cavity into stiff, airtight compartments are necessary. Instantaneous pressure equalization rarely occurs in reality so the cladding deals with more than rain.

A drained and vented screened wall that is both pressure moderated and ventilated is not only feasible, it is the *preferred* solution for most applications.

Best Practice Guide:
Wood Frame Envelopes in the Coastal Climate of British Columbia

Contrary to the notions of snow bound folks in central and eastern Canada, the Vancouver climate is harsh. The West Coast environment is intolerant of design and construction practices that result in the accumulation of moisture in wood frame assemblies. In the winter Vancouver gets plenty of rain and little sun. A building's exposure to wetting is high, but the potential for drying is low. Moderate temperatures mean that the potential for condensation due to outward leakage of warm indoor air is low but the potential for fungal growth is high, even in winter.

Since 1985, there have been significant building envelope performance problems in wood frame residential buildings in the coastal area of BC. This is known in the popular press as the "leaky condo" problem. The problems are the result of water penetration and damage to interior finishes. However, the most alarming problem has been the extensive decay of structural wood. A CMHC Survey of Envelope Failures in the Coastal Climate of British Columbia (Solplan Review No. 72, Jan. 1997) identified key aspects of the design, construction, operation and maintenance processes leading to the problems. It also gave the construction industry the basis for the development of solutions.

It seems as if suddenly the entire industry has discovered the importance of building science. A new specialty - the building envelope specialist, is emerging. The Architectural Institute of B.C. has developed a course curriculum for a 4 module, 8 day course for professionals that is the basis of the specialist training.

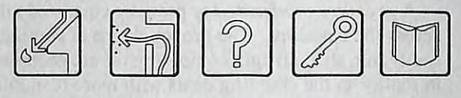
Another tool nearing completion is the Best Practice Guide (prepared by RDH Building Engineering Limited with Morrison Hershfield Limited, Hewitt Tan Kwasnicky Architects, and Don Onysko) which is intended to provide guidance for the design and construction of building envelopes. This document will be updated as feedback is received and more current technical information becomes available. It is one element of the response to the recommendations made in the CMHC Survey. Although targeted to coastal BC, much of the material may also be applicable to other climate zones and building types, provided it is used with due care.

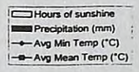
The Guide's primary focus is on the management of moisture. Although the document has been extensively reviewed, it still comes with a cautionary note that care be taken when applying the information it contains. The responsibility remains with the user to apply professional judgement when using the information.

In the interests of distributing the information as quickly possible, a draft copy is now available. Registered purchasers will receive the final version (including a CD with all the drawings) when it is published later this year.

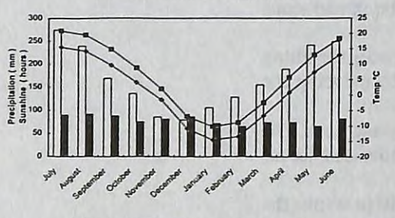
The Guide is a good building science reference. It is not meant to be bedtime reading (except for insomniacs looking for a cure), but does provide valuable information that has been either forgotten or ignored by too many practitioners. The focus is on evaluating all details keeping in mind that a building-is-a-system, greater than the sum of the parts. The Guide does not simply offer a series of details that can be dropped into a set of drawings, but presents material in a way that users must evaluate their options before making a decision on details.

A handy presentation feature is icons in the margin that highlight and reinforce concepts in the adjoining text. They draw the reader's attention to key points that might otherwise be overlooked.

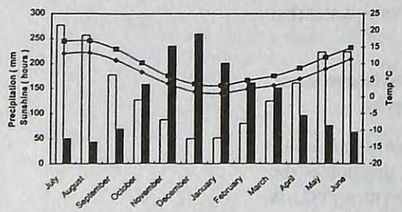




Climate Information - Montreal



Climate Information - Vancouver



Climate information for Vancouver and Montreal show the diversity of climates. The charts show how the warm temperatures, low sunlight and high amounts of precipitation in Vancouver mean the drying potential is low. The climate profile for Montreal is not unlike that found in most prairie and central Canadian locations.

Best Practice Guide: Wood Frame Envelopes in the Coastal Climate of British Columbia *The publication will be available for $89.95 from CMHC (tel. 1-800-668-2642). A limited number of draft copies are now being sold through the Vancouver CMHC Office (tel. 604-731-5733).*

Solving Basement Problems

Basement cracks and leaks are among the most common sources of callbacks and warranty claims in new housing. Problems apply equally to poured concrete foundations and slabs, concrete block walls, and preserved wood foundations (PWFs), and usually reflect inadequate design and construction practices.

The cost of repairs to foundations almost always exceeds the cost of better construction practice in the first place.

The major problems can be divided into two categories: problems which result in structural deterioration and damage; and those which result in water leakage and moisture damage. The causes of both types of problems are often similar.

Cracks and Spalling from Poor Construction Practices

Cause: Overwatering

The addition of 4litres of water to 1 m³ of concrete will decrease its strength by more than 1 Mpa (145 psi) and increase slump by 25 mm (1 in.).

Solutions

Never add water on the construction site. Adding water alters the water-cement ratio of the mix, resulting in a loss of strength and the potential for increased shrinkage and reduced durability and watertightness.

Where workability and movement of concrete are a problem, use pumped concrete, or have the supplier increase the slump of the concrete by changing the proportions of the aggregate, by adding a superplasticizer, or by increasing the percentage of air entrainment.

Pour basements from several points to minimize the need to "flow" the concrete around the forms.

Shovel or pump out wet sites to prevent standing water and mud from mixing with the poured concrete. The concrete should be placed on undisturbed soil or well-compacted fill.

Cause: Improper curing of concrete

Concrete will only reach its full design strength if it is allowed to cure properly in conditions that minimize the loss of the original water from the mixture. Where forms are stripped early, backfilling of the wall could prove disastrous if the concrete has not become strong enough.

Solutions

Moist-cure the concrete for as long as possible.

Keep the concrete continuously moist unless formwork is left in place for a minimum of 24 hours. Improved performance will result from leaving formwork on for a minimum of two days. It is recommended that slabs be moist-cured for a minimum of three days.

The combined effects of overwatering and improper curing can result in very weak concrete. For example, if you start with a design mix of 15 Mpa (2175 psi), add 18 litres of water per cubic metre on site, and strip forms within 18 hours, the resulting concrete will have a 28-day design strength of as low as 5 Mpa (725 psi). Where proper curing practices are not followed, 30-Mpa (4350 psi) concrete should be used.

Cracks in Foundations & Slabs (Frost Heaving & Freezing)

Cause: Footings that do not extend below the frostline

Most commonly, this problem occurs at garage frost walls and basement walk-outs where excavations may not be deep enough to get below the frostline.

Building better is almost always less expensive in the long run - financially and in terms of maintaining good client relations.

Building Solutions is the latest professional book from CMHC. It is an update of the old CMHC Builders' Series booklets compiled into a single document, designed to help builders reduce the expense and aggravation of construction defects and callbacks. By identifying the sources of the most common problems and by reviewing the problems themselves, you can focus on preventing deficiencies by improving procedures.

Building Solutions is not a "how-to" manual. Rather, this book can serve as a refresher for experienced builders. It can also warn you of the types of problems that might result from cutting corners, or from applying inadequate quality control procedures.

This piece is adapted from: ***Building Solutions, A Problem Solving Guide for Builders and Renovators***
Published by CMHC $39.95
Tel: 1-800-668-2642 Fax: 613-748-4069
Also available in selected bookstores across Canada

Solutions

Ensure that all footings are located below the frostline or are protected by an insulated skirt.

All footings, including those supporting garages and those below basement walk-outs, must be maintained below the depth of frost penetration.

Shallow footings should be professionally designed to minimize frost penetration. Use vertical and horizontal insulation to protect the footings.

Cause: Moisture in soil adhering to the foundation wall and the lifting foundation

This problem usually occurs at garage frost walls, which are not subjected to high interior heat.

Solutions

Isolate the wall from the moisture in the soil or minimize the likelihood of moisture in the soil that is in contact with the foundation wall.

Keep frost-susceptible soils away from the foundation wall. Provide a capillary break between the soil and the foundation wall. Use free-draining backfill, free-draining insulation, or air gap membrane products to isolate the foundation wall from the moisture-laden soils.

Install drainage tile to remove moisture from around the footings, or install a granular drainage layer over soil graded to a sump pit.

Moisture Damage to Interior Insulated Foundation Walls

Cause: Air leakage behind insulation

When interior insulation is applied to foundation walls, the surface temperature of the walls will decrease. When warmer humid air in the basement passes over the foundation walls, moisture in the air will condense out - sometimes resulting in puddling or staining under and out from the insulated wall section.

Solutions

Ensure that interior frame walls are air-sealed at the base and top to minimize air leakage and air circulation behind the insulated cavities.

Install a moisture barrier/damp-proofing on the interior face of the foundation wall to protect wood framing and insulation from moisture in the concrete. The barrier should extend from the base of the foundation wall to the level of the exterior grade.

When framing interior walls, use a sill gasket material (instead of polyethylene or building paper) under the bottom plate to reduce air leakage between the wood and concrete, or seal the drywall to the concrete at the base of a finished wall.

Install an effective air barrier system, using either 6 mil polyethylene (0.15 mm) or airtight drywall (ADA) to prevent air leakage. Penetrations through the air barrier (service entrances, electrical outlets, furnace vents, ventilation exhaust and intake ducting, etc,) must be carefully sealed to prevent air leakage.

Cracking of Slab

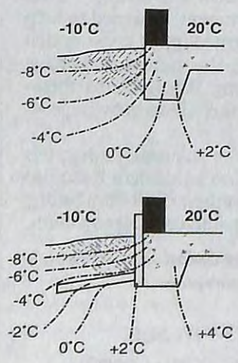


FIGURE 40
EFFECTS OF SKIRT INSULATION

Cause: Frost heave

Frost heave can occur where moisture in the soil under a slab-on-grade freezes, expands, and exerts vertical and horizontal pressures. As a general rule, frost heaving will happen at the perimeter of the slab where frost penetration is more significant.

Solutions

Prevent soil below the slab from freezing

Never pour concrete on a frozen subgrade.

Provide heat in the house during construction to prevent freezing of the soil below the slab.

Provide skirt insulation around the perimeter of the foundation.

Insulating vertically and horizontally out from the slab perimeter with an appropriate amount of rigid insulation can maintain soil temperatures above the freezing point in most parts of Canada. Insulation at corners of the slab will need to project further to accommodate higher levels of heat transfer. The amount and location may need to be engineered.

Ensure that any perimeter insulation extending over the slab above grade is protected with parging, flashing, or another rigid material (metal, or pressure-treated plywood).

Measuring Green Buildings

The R-2000 New Home Program lays out a standard by which houses can be measured for their energy and environmental performance. Although they are superior to standard construction, R-2000 houses represent only the first step toward environmentally responsible, sustainable construction. But what about larger scale building?

At this time there is no accepted definition for "green building" although most would agree that it refers at least to energy and environmental issues. A more detailed definition of "green" is difficult to establish as the term could cover any number of characteristics such as energy efficiency, greenhouse gas emissions, recycling capability and the longevity of the building, to name just a few.

There is also confusion in the use of the term "sustainable buildings." Although both "sustainable" and "green" deal with energy and environmental concerns, "sustainable" also involves issues of social equity, participation and economics which are more appropriate to a social, rather than a building level of analysis.

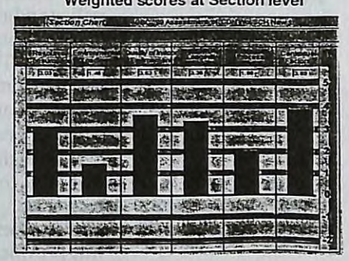
An attempt to define the terms was made at Green Building Challenge '98, an international conference sponsored and organized by Natural Resources Canada (NRCan) held in Vancouver last October. Conference delegates were able to learn about the best green buildings from around the world.

Green Building Challenge '98 was not a regular conference. It came at the end of a two-year process that involved teams from 14 countries. The goal was to establish a worldwide standard for environmental performance assessment of buildings, so that meaningful comparisons could be made of buildings built in various climates, and in regions with varying environmental concerns.

The national teams assessed 30 buildings using the ***GBTool*** before the meeting. GBTool is a performance assessment tool, the basis for second-generation "green building" design guidelines, and to provide a tool for building eco-labelling. The tool itself is, in computer terms, still in its Beta version - mostly there but still needing refinement. It has been designed to be modified to suit variations in national, regional and building-type characteristics.

GBTool can be modified to suit variations in national, regional and building type characteristics. Assessments are compared with applicable regulations or industry norms in the region and can be used at various levels of detail, from general assessments to detailed evaluations. It also provides consistency between levels of assessment and terminology, as its scoring system accepts both "hard" (quantitative) and "soft" (qualitative) data in a similar format.

The issues that are analysed include resource consumption, environmental impact, indoor air quality, durability, process, and context factors. Results are summarized in a bar graph chart on a scale of -2 to +5. In this way *GBTool* makes it easier to compare a building with others world wide and in the same community. In the long term, performance labelling has the potential to change market demand - so that selling new green building ideas will be easier.



Typical summary output chart of GBTool

A wide range of building types and sizes were studied for presentation at the conference. They could be considered some of the best examples of green building design at this time. All were already built, or nearing construction, so much actual information about the buildings is known, including the one of common interest: the cost. Although some were public sector buildings built as demonstration projects, most were built within the normal real world constraints.

Projects ranged from a ten-apartment public housing project in Finland built at no incremental cost, a small low income housing project in Poland, a 41 unit co-housing project in the USA, an energy efficient office building in the Netherlands, several schools in Europe, to major office and research laboratory buildings in Canada, USA and Europe.

The green building concept not only applies to new construction, but can also (and probably should be) applied to renovation work. Most of the building stock of the next century has already been built. Rather than tear down and build new to satisfy new needs, we should be encouraging adaptive reuse of existing structures. One of the renovation projects evaluated was the redevelopment of the Presidio in San Francisco. This is the old army base by the Golden Gate bridge, and is considered a national historic landmark, so that the limitations were not only the existing structure, but also the design features that had to be preserved.

R-2000™

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

Technical Research Committee News

Canadian Home Builders' Association

Building Code Development Process

The National Building Code of Canada is developed for the Canadian Commission on Building and Fire Codes by the NRC's Institute for Research in Construction. The code is a model code only, as building regulations are the responsibility of the provinces and territories. Up to now, once the model code was issued (every five years), each jurisdiction took it upon themselves, based on policy and available resources, to review and make amendments to the latest changes to meet local concerns. This inevitably created much duplication of effort and long time delays for implementation of changes. In BC and Ontario, the local changes were significant.

Although each jurisdiction wants to be certain that local conditions are addressed, there is also a recognition that a more uniform national code would be beneficial to the entire industry. That is why provincial and territorial representatives have agreed to a new approach to handling code changes. Proposed code changes, whether they are submitted to the NRC or at a provincial level, will now be reviewed by local jurisdictions before being reviewed by the Canadian Codes Centre with a formal public review before incorporation in the code (if appropriate). By having the provinces involved in the review process early it is hoped to reduce the duplication of effort, and involve local jurisdictions more directly.

Although a new edition of the code is not due until 2003, and the intent is not to introduce changes for the sake of changes, there are many circumstances where there are legitimate reasons for making changes. So if anyone wishes to propose code changes, they may now do so through the provincial agency responsible for the building code with the certainty that the proposal will be reviewed not only locally, but also at the National Building Code level.

Proposed code changes must be justified, including a statement of the problem, proposed change, and include an analysis of any cost and enforcement implications the changes may create.

Quiet Fans

For mechanical ventilation to be effective, equipment must be operated continuously. One of the biggest problems identified in BC is that home owners will not operate fans that are noisy. After all, who wants to have a rumbling fan running all night? That is why the BC code now requires that continuously operating fans have a sound rating no greater than 1 sone, and intermittent, timer-controlled fans no more than 1.5 sones.

Fans that meet these stringent criteria that have been identified to date are listed in the enclosed table.

Fan Ratings

1.0 sones or less		approx capacity (cfm)
Nutone	QT130	100
Panasonic	FV-08VQ	90
Panasonic	FV-12VQ	110
Mr. Whisper	S100	90
1.5 sones or less		
Nutone	LS-100	92
Panasonic	FV-11VQ	110
Panasonic	FV-20VQ	190
Reversomatic	RS-95	71
Reversomatic	QFC-125	105

ACT Program

Regulations and procedures covering development and construction of a house have evolved over many years. What had meaning years ago may not today, due to changing lifestyles, demographics and technological change. Regulatory reform could improve housing affordability, quality, choice and innovation. However, there are many players involved: municipal and provincial governments, the building industry and consumers. Starting the change process can seem like trying to move an immovable object.. That is why the Federation of Canadian Municipalities, the Canadian Home Builders Assoc. and Canada Mortgage and Housing Corp. have teamed up on a regulatory initiative known as ACT or Affordability and Choice Today.

This is a funding program that supports demonstration projects, streamlined approvals process projects, and case studies of regulatory reform projects. Municipalities, builders and developers are eligible to apply.

One example of a project funded under this program was in Chilliwack, BC, where a modified approval process for building permits was introduced. Builders with registered housing professional standing from the CHBA-BC in effect take care of the building permit process themselves.

The ACT program offers an opportunity to put into practice the reforms so many of us say need to be done.

Case studies of completed projects can be obtained from CMHC's housing information centre (tel. 1-800-668-2642, or on the web at: http://www.cmhc-schl.gc.ca).
More information and application forms can be obtained from the ACT Program co-ordinator at 613-237-5221 or your local CMHC contact person.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.
Canadian Home Builders' Association,
Suite 500, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail: chba@chba.ca
http://www.chba.ca

Letter to the Editor

Re November Editorial (Solplan Review No. 83)

Your item, specifically the last paragraph, has been taken by one of our members as a knock on the whole industry. We take exception to your statement that the industry cannot be trusted to police itself and in fact SHBA has been trying to obtain industry/government self administration for years.

We agree that the industry has an increasing risk due to the growing litigious nature of society but your statement seems to attack the whole industry. We do not agree we have the same problems as BC.

Your publication is read nationwide. I believe your last paragraph was referring to B.C. only, but since our member felt it attacked all builders, I felt it best to raise this concern.

Ken McKinlay
Executive Director, SHBA

Yes, the specific reference was meant to apply to the situation in BC. However, the situation in BC is only the most recent high profile problem. I think we can find many similar cases in all parts of the country (and probably in other countries too). People are always willing to cut corners by not following even minimal standards. When problems come up, as they will, it merely reinforces the unfortunate image too many people have of our industry as rapacious and insensitive; one that will do whatever it takes to make that extra buck.

We have a hard time acknowledging that many standards and regulations have been introduced over time in reaction to problems that have arisen. A legislated level playing field is one way society has of setting credible standards to overcome problems.

The lousy image we face is not generally merited, but it has emerged because of the bad apples in the industry. Let's face it, the image people have of our industry is because of the excesses of fly-by-night renovators and marginal contractors. Most people either directly or through someone they know, have had the experience of bad encounters with builders. It is the biggest obstacle the professional renovator faces (and one reason for the growth of the do-it-yourself market). However, new home builders, single family or multi family, are also affected.

As marketing people say, you not only have to attract customers, you have to retain them. After-sales service and all that. Unfortunately, too often this is not done. As I have said often, we as an industry collectively have to find a way to change the image. This is going to mean taking innovative steps, such as generic promotion of the industry, not just company specific promotion. It will mean finding ways of getting the message out that we really mean what we say when we question new regulations. We will have to address issues on their own merits, and not just through the filter of initial cost. For example, if we say we are supportive of environmentally responsible building approaches, we should not fight upgraded insulation standards or recycled content material requirements only on the cost argument. Ed.

Why do people buy wood stoves in 1999?

Wood burning heating appliances may not be in use everywhere, but they still represent a big segment of the market. In many locations wood can still be considered an appropriate fuel.

A recent survey for The Hearth products industry analyzed consumer motivation. Utilities and builders will also find the results interesting.

Most wood stove purchasers rely on electricity for space heating. Almost half decided to purchase a wood burning appliance to save money because electricity was too expensive. Other motivators were the added comfort provided by a wood burning appliance, the appearance of the fire and the fact that wood is readily available.

Choice of the unit was based mainly on efficiency or appearance. Price was a minor factor.

Product labelling, especially related to emissions, influenced most buyers, as almost three-quarters of the respondents purchased an EPA-certified appliance.

Most wood stove purchasers use their wood stove regularly. Electrical utilities want to know when wood heaters are used. It appears that wood appliance use is similar to peak-time use of electricity because two-thirds of of users surveryed loaded their wood appliance in the morning. Half load it in the late afternoon or early evening.

A key feature of wood combustion is that it requires proper design, installation and maintenance, especially for chimneys.

Flue gases contain a variety of products, especially if combustion is not complete. These flue gases will condense in the chimney when the temperatures are cool, and are a cause of chimney fires when the flues are not maintained regularly. The build-up of condensed flue products is highest for appliances with exterior chimneys (those that run up the outside of an exterior wall and are exposed to the outside air). This type of chimney usually requires more frequent cleaning. In the survey, one third of the respondents had an outside chimney; however, there was no significant difference in sweeping frequency between those with exterior chimneys and those with chimneys central to the house.

What about the impact on insurance premiums? One quarter said they were charged an extra premium or a surcharge on their insurance after a wood burning appliance was installed. The premium increase or surcharge varies from less than $30 to more than $50.

Hearth Products Association of Canada
Etobicoke, ON
Tel.: 416-626-6568
Fax: 416-620-5392

Top Ten Innovations

Every innovation and advance in technology has many viewpoints. We often bemoan that consumers are only interested in the sizzle, and not the substance of construction. Yet, some technical issues receive considerable scrutiny.

Looking at what catches the attention at a high profile demonstration is interesting. The table shows polling results of visitors to the Waterloo Advanced House. Putting the top ten features identified by builders and general public side by side is interesting. While builders focus on the products and construction systems, consumers show a higher interest in design issues.

The demonstration was completed and the house sold more than four years ago. Some technologies have become commonplace, but others have not proved themselves. However, the results are still interesting, and probably would not be significantly different today. Results would probably be similar if such a survey had been taken at the other Advanced Houses in the country.

	Builders' Perspective	Consumer's comments
1	High performance windows	High performance windows
2	Engineered wood products	Liveable basement
3	Cellulose wall insulation	Re-cycled flooring
4	Pre-cast foundations	Cathedral ceilings
5	Low water consumption toilets	Appliances (incl. energy efficient, CFC-free refrigerator)
6	Crushed glass aggregate	Crushed glass interior window (interior window screen)
7	Solar hot water heater	Formaldehyde free products
8	Compact fluorescent lamps	Sponge paint (interior wall finish treatment)
9	Recycled content drywall	Rubber pavers (exterior landscaping)
10	Simple thermostats	Thermochromic windows (properties change at preset point)

Borate Treated Lumber

Wood-destroying insects vulnerable to Borates include:
- two-toothed long horn beetle
- common furniture beetle
- carpenter ant
- oldhouse borer
- drywood termite
- eastern subterranean termite
- pacific dampwood termite

Boron is an environmentally benign wood preservative used in South East Asia, Australia, New Zealand and the United Kingdom for several decades. It has a well known and a proven track record but is new in Canada. Borate treated wood is now being marketed in Canada under the Advance Guard trademark.

Borates provide protection against fungal attack and a range of wood-destroying insects, including carpenter ants, wood-boring beetles, Formosan and other subterranean termites.

Borate treated wood is intended only for interior use and above-grade protected applications. On a construction site borate treated lumber and plywood must be kept dry, off the ground, undercover and protected from the weather. In use it requires permanent protection from the weather and should not be subject to direct wetting, as water will leach the salt out of the wood.

The distributors of borate treated lumber see opportunities to use it in high moisture areas to retard fungal action such as for repairs to "leaky condos" and for framing in high moisture areas like bathrooms and kitchens.

Unlike other preservatives, borates do not affect most ferrous metals, wood fasteners or screws. They have little or no effect on most plastics, rubber, putties, bituminous solutions, other sealants or primer paints.

Advance Guard Protected Wood is treated with an inorganic boron-oxygen compound in a water-based solution applied by pressure treatment using a vacuum/pressure treating process that forces the preservative into the wood. After treatment, the wood must be dried.

The active ingredient in Timbor Industrial Wood Preservative is Disodium octaborate tetrahydrate (DOT). DOT is low in acute mammalian toxicity, toxic to insects and fungi, odourless, colourless, non-corrosive, not susceptible to thermal or photochemical degradation.

Typical applications for borate treated wood are:
- Sill plates
- Joists
- Flooring
- Studs
- Framing lumber
- Sheathing/plywood
- Truss rafters

Advance Guard Protected Wood is now available at some building yards throughout Canada. The price is quoted are being "slightly higher than regular pressure treated lumber".

For identification purposes a blue colouring is added to all Advance Guard Protected Wood. Each piece is marked with the logo, name and location of the treating plant, the year treated and the retention level of the salts.

Information:
Timber Specialities Ltd.
Campbellville, Ontario
Tel: (905) 854-2244
Fax: (905) 854-0834

Wood Stove Marketing Campaign

After years of neglect and criticism, the wood stove's image got a big boost during last January's ice storm when thousands in Eastern Ontario and Quebec could stay in their homes because they had a wood stove to keep warm and for cooking. To capitalize on this renewed goodwill toward wood heat, the Hearth Products Association of Canada has launched a stove change-out program in Eastern Ontario. The program offers substantial trade-in rebates on purchases of advanced technology wood stoves, fireplaces, fireplace inserts and pellet stoves certified as clean burning by the Environmental Protection Agency (EPA).

Residential wood burning is a significant source of air pollution in Canada. According a 1995 Environment Canada study, residential fire wood combustion is responsible for about 25 per cent of fine particulates found in air pollution, 15 per cent of volatile organic compounds, and 10 per cent of carbon monoxide.

The change-out program is designed to promote responsible wood burning. The intent is to improve air quality by promoting cleaner and more efficient wood burning, through better wood burning practices and by encouraging purchases of cleaner-burning certified wood stoves or fireplace inserts. Rebates will be awarded only if the old unit is removed from service (never to smoke again). An incentive to upgrade is provided by retailers and manufacturers who have teamed up to give sizable discounts to householders who trade in their old wood burners on advanced technology stoves and fireplaces.

This program shows the confidence that the hearth products industry has in their new products. A wood heater is more than just a lifesaver during emergencies like winter storms. Wood heat may still have a place even in modern new homes.

The Eastern Ontario Wood Stove Changeout is a joint initiative of the Hearth Products Association of Canada, the Lanark/Leeds Green Communities Association, the Assoc of Registered Wood Energy Technicians of Ontario, Renewable Energy in Canada, wood stove manufacturers and retailers, with support from Environment Canada, Natural Resources Canada, and the Ontario Ministry of the Environment.

For information: call the Changeout hotline at 1-888-358-9388.

Energy Answers

Rob Dumont

In most Canadian houses, the water heater is the second largest user of energy. However, the efficiency of most gas or propane fired water heaters is quite anaemic, with annual efficiency values typically less than 60%. What can be done to improve the efficiency of the heaters?

Here is my top ten list of things to improve the efficiency of your hot water system.

1. Lower your tank water temperature setting *is the cheapest efficiency measure you can employ.* Some people have their water heaters set as high as 145 °F (63°C). This is too high, resulting in substantial heat losses and the risk of scalding from the hot water. Conversely, some years ago there were recommendations to lower water temperatures as low as 105 °F (41°C). This is too low, and will allow legionella and other bacteria to grow inside the water heater. A good water temperature is about 125 °F (52°C), high enough to prevent legionella, yet low enough to limit tank losses and prevent scalding.

Lowering the temperature is not recommended if there is insufficient hot water capacity in the house. However, the temperature of electric hot water heaters should not be set lower than 131 °F (55°C).

2. Reduce your use of hot water by installing water conserving shower heads, aerating taps, and a horizontal axis clothes washer. Horizontal axis clothes washers use less than half the water of the standard vertical axis (top-loading) machines. The smaller the demand for hot water, the lower the bill.

3. Insulate the water heater to limit heat loss from the jacket. Most water heater blankets on the market are only about one or two inches thick. A better insulation thickness can be achieved by adding R20 (6 inch thick) batts. The trick is to place the batts vertically against the water heater, and to cover the batts with an aluminum or vinyl-backed blanket insulation material. The batts need to be cut like barrel staves so that they fit properly. With any of the natural gas, propane, or oil fired water heaters, it is VERY IMPORTANT that the air supply to the burners and to the draft hood at the top are not obstructed.

I used this insulation technique on an electric water heater, and the standby heat loss was reduced from 100 watts (341 Btu/hour) to 25 watts. I have found that a thin wire is the best for holding the insulation against the tank. Most duct tapes do not have enough staying power.

4. Put the water heater near the end uses. This, of course, is easiest to do in a new house. By having only a short distance for the water to travel, the heat loss from the piping is reduced. Even if the pipes are insulated, the water in the pipes will cool quickly and the heat from the standing water in the pipes is lost.

5. Install an uninsulated preheat tank (30 or 40 gallons) upstream of the water heater. This preheat tank will absorb heat from the air in the house throughout the year. Although you are 'robbing' heat from the house during the heating season, the tank will draw heat from the house during the summer period. Incoming water temperatures can be quite cold. In Saskatoon, the ground water temperature is as low as +3°C (38 °F) in the late winter months, rising to about +18°C (65°F) in the summer.

6. Place insulation on the cold water inlet and the hot water outlet piping. Most water heaters have the piping at the top of the heater. Considerable thermal convection can occur on the pipes. You can notice this on water heaters that do not have pipe insulation. Quickly touch the pipes near the top of the water heater. Even if there has been no water draw in the last half hour, they will be hot.

7. Install anti-convection loops on the water heater. The easiest anti-convection loop to make is to use a soft copper loop about 6 inches in diameter on the inlet and outlet pipes

8. Install a vent damper on the water heater. Several U.S. companies produce a thermally-activated vent damper that can be retrofit on water heaters. Be sure to check that they are legal in your area.

9. Install a solar water heater. These are not cheap, but are financially attractive in most parts of Canada especially where electricity is the fuel of choice.

10. Install a condensing water heater. There are at least two companies that produce condensing water heaters for domestic water heating. These units are not cheap, and tend to be quite large in capacity. However, the units can also be used to provide space heating in well insulated houses.

After The Flood

Recovering from a Flood

Regrettably, springtime in many areas is also flood time. We hope there will not be too many disasters this year, but if there are, we thought we would summarize a CMHC publication on how to deal with the aftermath of a flood.

After a flood, it is important to restore a home to good order as soon as possible to protect the health of occupants and prevent further damage to the house and belongings.

Before starting clean up, shut the power off to the flooded area at the breaker box. Wear rubber boots in any flooded area with standing water 2" or more deep. Keep extension cords out of the water.

Record details of damage, with photos or video if possible. Set up a step-by-step action plan to:

- remove all water, mud and other debris;
- dispose of contaminated household goods;
- rinse away contamination inside the home,
- remove the rinse water;
- disinfect and dry out the house and salvageable household goods

Household goods contaminated by sewage or wet for a prolonged time should be thrown out, except for solid material products (wood, metal or plastic) that can be cleaned and disinfected.

Always use gloves, masks and other protective gear, as chlorine bleach and non-ammonia dishwashing detergent will be needed. Never mix bleach with ammonia - the fumes are toxic. Clothing and bedding should be hung out to dry. Valuable papers should be placed into a freezer for later work.

Starting Site Work

- Immediately add small amounts of chlorine bleach to standing water
- Remove standing water with pumps or pails, then with a wet/dry shop vacuum.
- Remove all soaked and dirty materials and debris, including wet insulation and drywall, residual mud and soil, furniture, appliances, clothing and bedding.
- Hose down any dirt sticking to walls and furnishings, then rinse several times, removing the remaining water with a wet/dry shop vacuum.
- Wash and wipe down all surfaces and structures with chlorine bleach, ensuring that there is adequate cross ventilation to remove fumes. Then rinse again.

Wipe down surfaces that have not been directly affected with a solution of one part chlorine bleach to four parts cold or tepid water. Ventilate or dehumidify the house until it is completely dry.

Work from the top down. Remove wall materials that have been soaked at least 500 mm (20 in.) above the high-water line.

Rinse, then clean all floors as quickly as possible. Replace flooring that has been deeply penetrated by flood water. Carpets must be dried within two days, otherwise they should be taken out. Sewage soaked carpets must be discarded.

Clean all interior cavities with a solution of water, chlorine bleach and non-ammonia dish detergent and dry thoroughly, checking for mould and killing it with chlorine bleach. Ensure that structural members are dry.

Flooded appliances, electrical outlets, switch boxes or fuse/breaker panels should be tested before use. If they have been soaked, replace the furnace blower motor, switches and controls, insulation and filters. Inspect all flooded forced air heating ducts and have them cleaned out or replaced. Replace insulation inside water heater, refrigerators and freezer if it has been wet.

Flush and disinfect floor drains and sump pits using undiluted chlorine bleach, and scrub them to remove greasy dirt and grime.

Always make sure workers wear protective gear and the house is well ventilated, using large fans and all windows open.

Index to Solplan Review No. 66-83

This index covers issues No. 66 to 83. An index to issues 51 - 65 appeared in Solplan Review No. 66 (Jan 1996) and issues 1 - 49 in Solplan Review No. 50 (May 1993).

If you are missing any back issues, a limited number of most are still available for $5.00 each.
SOLPLAN REVIEW, Box 86627, North Vancouver, BC V7L 4L2

How Much Does Gasoline Really Cost?

Is Price a True Indicator of Value?

Decisions on many technical issues are made based on cost justification. But how accurate are energy prices? A recent report in the USA has found that the cost of gasoline to the US economy is somewhere between US $5.60 and $15.14 per gallon. This is equivalent to Cdn$ 2.22 and Cdn$ 6.00 per litre. Yet the gas pump price is Cdn$.43 - .52 per litre!

The calculated costs include the cost of tailpipe emissions, industry credits, military protection of oil supplies and other external costs such as external environmental, health and social costs that too often are not factored in. While this was a US study, looking at the US situation, it would not be much different in Canada or most other developed countries - just the details may vary.

So think about these hidden costs next time you insist on considering the "economic" cost of an energy upgrade.

Coming Events

February 14-17, 1999
CHBA National Conference
Regina, SK
Tel: 905-954-0730
Fax: 905-954-0732

February 22-23, 1999
Greenprints '99: Sustainable Communities by Design
Atlanta, GA
Tel: 404-872-3549
greenprints@southface.org

March 4-5, 1999
World Sustainable Energy Day 1999
Wels, Austria
www.esv.or.at/esv/
Fax: 43-732-6584-4383

March 6-7, 1999
Housing Tech '99
CHBA-BC's Housing Technology Forum,
Surrey, BC
Tel: 604-432-7112
1-800-933-6777
Fax: 604-432-9038

April 19-24, 1999
Affordable Comfort
Chicago, IL
Tel: 724-852-3085
Fax: 724-852-3086

May 18-20, 1999
Canada's Energy Efficiency Conference
Ottawa, ON
Tel: 1-800-342-7146
Fax: 613-233-4766

August 11-14, 1999
North Sun '99 (International conference on solar energy in high latitudes; includes Solar Energy Society of Canada annual conference).
Edmonton, AB.
Tel: 613-234-4151
Fax: 613-234-2988
e-mail: NorthSun@cyberus.ca

SOLPLAN REVIEW is an independent Canadian Journal published 6 times per year to serve the needs of professionals and interested lay persons. It provides news, technical details, new product information, insights and commentary on developments covering all aspects of building science and energy efficient building practice for new and retrofit residential construction. Technical information is presented in a clear, concise manner, without resorting to jargon.

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